

at least one light detector, the diffraction grating assembly comprising a fixed reflective grating assembly and a mobile reflective grating assembly, wherein the mobile grating assembly is mobile along a given displacement relative to the fixed grating assembly; wherein the fixed reflective grating assembly and the mobile reflective grating assembly diffract a portion of the incident light beam thereby producing interference and the resultant portion of the incident light beam detected by the at least one light detector.

2. A device according to claim 1, wherein the fixed grating assembly comprises a first reflective grating and the mobile grating assembly comprises a second reflective grating.

3. A device according to claim 1, wherein the fixed grating assembly comprises a first reflective grating and a fourth reflective grating and the mobile grating assembly comprises a second reflective grating and a third reflective grating, wherein the first grating and the fourth grating are of a first spatial period and are located substantially in a first plane, and the second grating and the third grating are of a second spatial period and are located substantially in a second plane, wherein the first plane is displaced from the second plane.

4. A device according to claim 1, wherein the fixed grating assembly is mobile relative to the incident light beam, and the mobile grating assembly is fixed relative to the incident light beam and is arranged between the light source and the at least one light detector.

5. A device according to claim 4, wherein the mobile grating assembly, the source, and the at least one detector form an integrated measuring head and the fixed grating assembly further comprises a first reflective grating that defines a scale for the device.

6. A device according to claim 5, wherein the detector is integrated in a semiconductor substrate bearing the mobile grating assembly.

7. A device according to claim 5, wherein the light source is integrated in a semiconductor substrate bearing the mobile grating assembly.

8. A device according to claim 1, wherein the fixed grating assembly has a first spatial period and the mobile grating assembly has a second spatial period that is half the first spatial period of the fixed grating assembly.

9. A device according to claim 4, wherein the fixed grating assembly has a first spatial period and the mobile grating assembly has a second spatial period that is half the first spatial period of the fixed grating assembly.

10. A device according to claim 8, wherein the resultant portion of the incident light beam is directed at a resultant angle relative to a plane perpendicular to lines along which the fixed grating assembly and the mobile grating assembly are formed, the resultant angle having a value substantially equal to an angle of incidence of the incident light beam multiplied by <<-1>> relative to an axis perpendicular to the fixed grating assembly and the mobile grating assembly, such that only light beams interfering along the resultant angle are measured by the at least one detector for determining a relative displacement.

11. A device according to claim 9, wherein the resultant portion of the incident light beam is directed at a resultant angle relative to a plane perpendicular to lines along which the fixed grating assembly and the mobile grating assembly are formed, the resultant angle having a value substantially equal to an angle of incidence of the incident light beam multiplied by <<-1>> relative to an axis perpendicular to the fixed grating assembly and the mobile grating assembly, such that only light beams interfering along the resultant angle are measured by the at least one detector for determining a relative displacement.

12. A device according to claim 10, wherein the incident light beam enters the fixed grating assembly at the angle of incidence which is not zero in the plane perpendicular to the lines along which the fixed grating assembly and the mobile grating assembly are formed, the angle of incidence being sufficient so that the light source and a detection region of the at least one detector are spatially separated from each other in projection in the plane perpendicular to the lines along which the fixed grating assembly and the mobile grating assembly are formed.

13. A device according to claim 1, wherein the fixed grating assembly comprises a dielectric layer of index n greater than 1.8.

14. A device according to claim 1, wherein the mobile grating assembly comprises a dielectric layer on top of a reflective substrate.

15. A device according to claim 2, wherein the first grating and the second grating are formed of several longitudinal secondary gratings of close but different frequencies thereby allowing an absolute displacement measurement over at least one range of measurement.

16. A device according to claim 3, wherein the first grating, the second grating, the third grating and the fourth grating are formed of several longitudinal secondary gratings of close but different frequencies thereby allowing an absolute displacement measurement over at least one range of measurement.

17. A device according to claim 1, further comprising at least one diffraction grating arranged beside at least one of the fixed grating assembly and the mobile grating assembly so as to define at least one reference position for the at least one detector.

18. A device according to claim 1, further comprising at least one diffraction grating having at least one offset or phase jump incorporated with the lines of the at least one diffraction grating so as to define at least one reference position for the at least one detector.

19. A device according to claim 1, wherein the at least one detector is arranged for measuring a relative velocity between the fixed grating assembly and the mobile grating assembly, wherein a sole measurement of a frequency of detected luminous intensity modulation provides the relative velocity.

20. A device according to claim 2, wherein at least one of the first grating and the second grating has a region with lines offset or phase shifted relative to lines of an other region.

21. A device according to claim 3, wherein at least one of the first grating, the second grating, the third grating and the fourth grating has a region with lines offset or phase shifted relative to lines of an other region.

22. A device according to claim 2, wherein at least one of the first grating and the second grating has a region formed of at least two secondary gratings having a same period and a same phase shifted or off set lines, the phase shifted or off set lines being provided so that the resultant portion of the incident light beam comprises two distinct beams that interfere and produce alternating luminous intensity signals varying as a function of relative position between the fixed grating assembly and the mobile grating assembly, whereby the alternating luminous intensity signals permits interpolation in an electric period of the luminous intensity signals and allows detection of a relative displacement direction between the fixed grating assembly and the mobile grating assembly.

23. A device according to claim 3, wherein at least one of the first grating, the second grating, the third grating and the

fourth grating has a region formed of at least two secondary gratings having a same period and a same phase shifted or off set lines, the phase shifted or off set lines being provided so that the resultant portion of the incident light beam comprises two distinct beams that interfere and produce alternating luminous intensity signals varying as a function of relative position between the fixed grating assembly and the mobile grating assembly, whereby the alternating luminous intensity signals permits interpolation in an electric period of the luminous intensity signals and allows detection of a relative displacement direction between the fixed grating assembly and the mobile grating assembly.

24. The device according to claim 5, wherein the light source comprises an electroluminescent diode.

25. The device according to claim 24, further comprising an optical collimation element arranged between the light source and the first grating.

26. A device according to claim 2, wherein the light source emits the incident light beam so that the incident light beam comprises a first partial beam incident upon the fixed grating assembly at a positive angle of incidence and a second partial beam incident upon the fixed grating assembly at a negative angle of incidence, the fixed grating assembly and the mobile grating assembly being arranged on either side of two regions of incidence respectively defined by the first partial beam and the second partial beam incident upon the fixed grating assembly so as to form first to fourth diffracted beams and to generate interference between the fourth diffracted beam and a fifth diffracted beam, thereby producing light detected on either side of the two regions by at least two light detectors arranged on either side of the two regions of incidence.

27. A device according to claim 8, wherein the light source emits the incident light beam so that the incident light beam comprises a first partial beam incident upon the fixed grating assembly at a positive angle of incidence and a second partial beam incident upon the fixed grating assembly at a negative angle of incidence, the fixed grating assembly and the mobile grating assembly being arranged on either side of two regions of incidence respectively

defined by the first partial beam and the second partial beam incident upon the fixed grating assembly so as to form first to fourth diffracted beams and to generate interference between the fourth diffracted beam and a fifth diffracted beam, thereby producing light detected on either side of the two regions by at least two light detectors arranged on either side of the two regions of incidence.

28. A device according to claim 26, wherein the source is attached to the mobile grating assembly so that a portion of the mobile grating assembly is situated on either side of the source and offset or phase shifted relative to each other portion so that alternating light signals resulting from interference as detected by the at least two detectors are phase shifted by  $\Lambda/2$ .

29. A device according to claim 26, further comprising a fifth diffraction grating arranged between the source and the first grating.

30. A device according to claim 26, wherein the source provides a substantially collimated beam propagating along a direction substantially perpendicular to the first grating.

31. A device according to claim 2, wherein at least one of the first grating or the second grating defines a bi-directional diffraction grating having a same spatial period along two orthogonal axes.

32. A device according to claim 2, further comprising at least first and second reflective surfaces, the first reflective surface arranged to deviate a first beam originating from the source and propagating substantially along a displacement direction in the direction of the first grating in order to provide the incident beam, and the second reflective surface arranged to reflect the interfering light along an output direction substantially parallel to the displacement direction before being detected by the at least one detector.

33. A device according to claim 32, wherein the source and the at least one detector are attached to the fixed grating assembly and the first and second reflective surfaces are formed on a rod supporting the mobile grating assembly.

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